Achieving the Post-construction Soil Standard

Preserving And Restoring Healthy Soils On Developments In King County

Healthy soil is vital to a clean environment and healthy landscapes. Deep soil that is rich in organic material absorbs rainwater, helps prevent flooding and soil erosion, and filters out water pollutants. Healthy soil also stores water and nutrients for plants to use in dry times, promoting healthy plants that require less irrigation, toxic pesticides, and other resources.

Land development and landscaping practices can damage these valuable soil functions by removing or compacting topsoil. The result is erosion, unhealthy landscapes that are difficult and expensive to maintain, polluted water, destroyed fish habitat, and increased need for costly stormwater management structures.

Amendments to King County's Clearing and Grading regulations KCC 16.82 help prevent costly environmental and landscape problems by requiring new developments to preserve topsoil, restore soils by adding compost after construction, or implement other measures to maintain the soil's moisture holding capacity. There are economical ways to retain the benefits of healthy soil, and avoid more costly damage to streams, wildlife, and human health.

This booklet explains how to preserve and restore soil quality and to meet these new code requirements.

Effective January 1, 2005

King County
Department of Development
& Environmental Services

Soil Treatment Options

There are four *Soil Treatment Options* that can be used to meet the post-construction soil standard.

These options can be used individually, or in combination (more than one may be used in different areas of a single site), so that they work best for the situation. The most convenient and economical methods for achieving the standards depends on site soil conditions, grading and subgrade compaction, practicality of stockpiling site topsoil during grading, and site access issues.

Choose Option 2, 3, 4a and/or 4b to restore soil quality after construction in areas where grading and soil disturbance are unavoidable, and follow these requirements:

- When amending soil, do so between May 1 and October 1 only.
- Avoid plowing or tilling within drip line of trees to be retained.
- Final soil depth should be a minimum of 8 inches.
- Test soil pH, and if necessary, adjust to suit proposed plants.

Option 1:

Leave native soil undisturbed, and protect from compaction during construction.

This option is the most economical and best for the environment, but is not always feasible.

- Plan site development to leave areas where native vegetation does not need to be disturbed.
- Fence off areas of native vegetation on the site that will not be stripped, logged, or graded to protect them from disturbance during construction.
- Undisturbed areas do not require soil amendment.

Regulatory Requirements

Except for areas that will be covered by impervious surface or have been incorporated into a stormwater facility, areas that have been cleared and graded must have the soil moisture holding capacity restored to that of the original undisturbed soil native to the site to the maximum extent practicable. Areas that have been compacted or had the topsoil or duff layer removed will be amended by adding compost, importing topsoil, stockpiling site topsoil, or through other techniques that are capable of mitigating for lost moisture holding capacity.

Soil amendment shall take place between May 1 and October 1. Replaced **topsoil shall be a minimum of eight inches thick**, unless the applicant demonstrates that a different thickness will provide conditions equivalent to the soil moisture holding capacity native to the site. Replaced **topsoil shall have an organic matter content of between 8 to 13 percent dry weight and a pH suitable for the proposed landscape plants**. (Note: 8-13% soil organic matter (SOM) content in soil is ***not*** the same as 8-13% by volume of compost in soil. This booklet explains how to achieve the required 8-13% soil organic matter content.)

It is also recommended that compacted subsoils be tilled or plowed before placing amendments or topsoil, and that planting beds be mulched with two inches of forest duff, ground bark, wood chips or other organic material after planting.

These standards apply to all site development activities, whether permits are required or not, except for surface mine operations conducted pursuant to permits issued by King County and the Washington Department of Natural Resources.

Option 2:

Amend existing soil in place.

Where the soil has been compacted or the forest duff or topsoil removed, the simplest way to restore soil quality is to rototill compost into the existing soil.

- Apply a layer of compost to existing soil at the **pre-approved amendment rate of 2.5 inches**. Use the worksheet in this booklet to calculate the amount of compost needed. *Retain copies of receipts for compost delivered to the site, as they will be used during inspection to verify the soil requirements have been met.*
- Rototill compost into soil to a depth of at least 8 inches. *Note that tilling to this depth will require repeated passes with a large machine, such as a tractor mounted or heavy rear tine rototiller.*

Option 3:

Import topsoil mix with 8 – 13% soil organic matter content.

Where subsoil is too rocky, compacted or poorly drained to amend effectively, a topsoil mix with 8 – 13% soil organic matter can be imported and placed on the surface. "Manufactured" topsoil mixes should be weed free, making them ideal for seeding new lawns.

- Import and apply a topsoil mix with 8 – 13% soil organic matter, which should contain 30 – 40% compost by volume, and clean sand or sandy soil. The soil depth should be 8 inches and the pH suitable for proposed plants. *Ask topsoil suppliers for test results of their product to verify the material contains the desired organic matter content and pH. Retain test result reports and receipts for material delivered to the site, as they will be used during inspection to verify that the soil requirements have been met.*
- For best results, plow or till compacted subsoil at least 2 inches deep before applying topsoil mix, and/or rototill some of the newly applied topsoil into the subsoil.

Option 4a – Native Soil:

Stockpile site duff and topsoil, and reapply after grading and construction.

NOTE: Option 4a is only applicable to sites that have the original, undisturbed soil native to the site. This will most often be forested land that is being converted in the current project. Topsoil and forest duff excavated for structures and paved areas, or removed before site grading, can be stockpiled and reapplied after grading or other construction disturbances are completed. Stockpiling may not be practical on small sites.

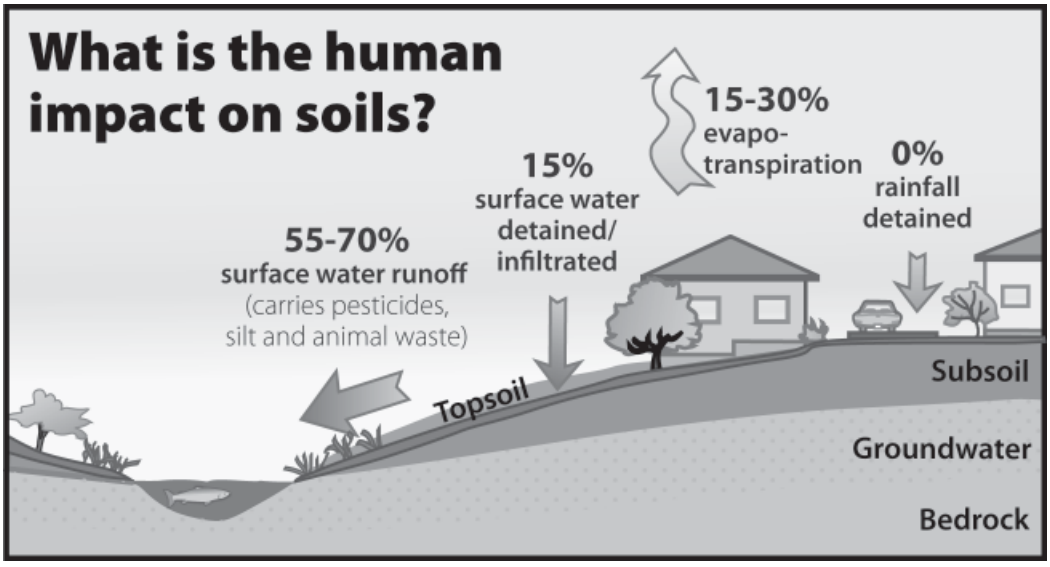
- Remove forest duff layer and topsoil and stockpile *separately*, in an approved location prior to grading. Cover soil and duff piles with woven weed barrier (available from nursery supply stores) that sheds moisture yet allows air flow.
- Reapply topsoil to landscape areas to a minimum 8 inch depth after grading and other disturbances are completed.
- For best results, plow or till compacted subsoil at least 2 inches deep before replacing stockpiled topsoil, and/or rototill some of the replaced topsoil into the subsoil.
- Apply a 2-inch layer of stockpiled duff as a mulch after planting.

Option 4b – Disturbed Soil:

Stockpile site soil, reapply, and amend in place.

NOTE: Option 4b is only applicable to sites where the soil is not the original, undisturbed soil native to the site. This will most often be unforested areas.

- Remove soil and stockpile in an approved location prior to grading. Cover soil with woven weed barrier (available from nursery supply stores) that sheds moisture yet allows air flow.
- Reapply stockpiled soil to landscape areas to a minimum 6 inch depth after grading and other disturbances are completed. In some cases, purchasing additional topsoil will be needed to achieve the 6 inch depth.
- For best results, plow or till compacted subsoil at least 2 inches deep before replacing stockpiled soil, and/or rototill some of the replaced soil into the subsoil.
- Apply a layer of compost to the reapplied soil at the **pre-approved amendment rate of 2.5 inches**. Use the worksheet in this booklet to calculate the amount of compost needed. *Retain receipts for compost delivered to the site, as they will be used during inspection to verify the soil requirements have been met.*
- Rototill compost into soil to a depth of at least 8 inches. *Note that tilling to this depth will require repeated passes with a large machine, such as a tractor or heavy rear tine rototiller.*



Pre-Approved versus Custom Amendment Rates

A pre-approved soil amendment rate has been calculated for the Soil Treatment Options presented in this booklet that require adding compost to existing or stockpiled soil. The pre-approved rate is 2.5 inches of compost, applied to the soil as directed. Use of the pre-approved amendment rate may simplify planning, however a custom calculated rate, based on tests of the soil and proposed compost, can save on effort and expense. Many pasture or woodland soils have adequate organic matter without amendment. Also, some compost products will provide the required soil organic matter content at lower application rates than the pre-approved rate. See *Soil Testing Laboratories* under *Resources* in this booklet for how to find accredited soil testing laboratories. For information on how to calculate and use custom amendment rates, see DDES worksheet *Calculating a Custom Soil Amendment Rate for use in Achieving the Post-construction Soil Standard*.

Figuring Compost, Stockpiling and/or Imported Topsoil Needs

STEP 1.

Review site conditions, landscape and grading plans.

- ❑ Examine site plans and soils. Use a shovel to dig in several areas that will be graded (or already have been) to determine if the newly exposed grades can be easily amended, or if compaction will require plowing/tilling of the subsoil or topsoil import. Determine if there are areas where soil could be stockpiled on-site.
- ❑ Identify areas where soil can be: left undisturbed (Option 1), amended in place with compost (Option 2), removed and replaced with purchased topsoil (Option 3), or stockpiled and later reapplied (Option 4a and/or 4b).

Permit Application Requirements

To ensure that the post-construction soil standard will be met, permit application submittal must include:

- A site plan marked to outline areas where each soil treatment option will be applied, and any stockpiling or staging areas.
- A brief written description of which soil treatment options you intend to use on each area of the site.
- Completed *Compost and Topsoil Calculations Worksheet* (see pages 5-6) showing the amount of compost and/or topsoil to be imported. *Retain test result reports and receipts for compost and/or topsoil delivered to the site. These will be used during inspection to verify that the soil requirement has been met.*

Soil pH

Use an accredited soil testing laboratory to test the pH of the soil and ask the laboratory to provide information on how to adjust the soil pH, should that be necessary. To find accredited soil testing laboratories, see *Resources* on page 7.

A nursery can provide specific information about suitable pH for landscape plants. Here are optimal soil pH ranges for various plant types:

Lawns – 5.5 to 7.5 pH

Shrubs (except acid-tolerant plants) – 5.5 to 7.0 pH

Acid-Tolerant Shrubs (Rhododendrons, Azaleas, Mountain Laurels, Camellias, Blueberries, native plants) – 4.5 to 5.5 pH

Annual Flower and Vegetable Gardens – 6.0 to 7.0 pH

STEP 2.

Select soil treatment option and suitable pH for each planting area.

Amending with compost is often the most economical way to bring poor soils up to the required soil organic matter content. On sites with the original, undisturbed, native soil, and where space permits, stockpiling and reapplying topsoil may be less costly. Importing topsoil usually costs more than amending existing soil, though it may be easier where subsoil conditions make cultivation difficult.

- ❑ Identify the areas where the selected Soil Treatment Option(s) (see pages 2-3) will be applied. Outline those areas on the site plan with a dark, thick-line pen.
- ❑ Assign each area an identifying letter (A, B, C…) on the site drawing.
- ❑ Determine desired pH for each lettered area, based on suitability for proposed plants (see *Soil pH* this page).
- ❑ Include required information with permit application (see *Permit Application Requirements* this page).

STEP 3.

Calculate compost and/or topsoil volumes for each area.

- ❑ Calculate the square footage of each lettered area on site plan.
- ❑ Use the square footage figures to complete the *Compost and Topsoil Calculation Worksheet*. This will give you the amounts of topsoil and/or compost (for 2.5 inch pre-approved amendment rate) in cubic yards needed to achieve the 8 inch soil depth.

STEP 4.

Identify compost and/or topsoils to be applied and retain records.

- ❑ Contact compost or topsoil sources and select products that meet the requirements, including 8 – 13% soil organic matter content for topsoil mixes and suitable pH for the proposed plants. Compost used as amendment or in topsoil mixes must be supplied by a permitted composting facility (see *Resources*).
- ❑ Retain compost and/or topsoil product delivery tickets and test reports, as they will be used as verification records during inspection.

Compost and Topsoil Calculation Worksheet

Option 1

Leave native soil undisturbed, and protect from compaction during construction.

Enter lettered areas from site plan where this option will be used:

_____ _____ _____ _____ _____ _____

No calculations for compost or topsoil are necessary for this option.

Option 2

Amend existing soil in-place (2.5 inch layer of compost).

Enter lettered areas from site plan where this option will be used:

_____ _____ _____ _____ _____ _____

Enter ***combined square footage*** of lettered areas in thousands _____
(example: for 4,525 sq ft, enter 4.525; for 500 sq ft, enter .5)

x 8

Multiply ***combined square footage*** by 8 and enter product in box **A** _____ **A** = **Cubic Yards**

AMOUNT OF COMPOST NEEDED FOR THESE AREAS

Option 3

Import topsoil mix with 8 – 13% soil organic matter (8 inch depth of topsoil).

Enter lettered areas from site plan where this option will be used:

_____ _____ _____ _____ _____ _____

Enter ***combined square footage*** of lettered areas in thousands _____
(example: for 4,525 sq ft, enter 4.525; for 500 sq ft, enter .5)

x 25

Multiply ***combined square footage*** by 25 and enter in box **B** _____ **B** = **Cubic Yards**

AMOUNT OF IMPORTED TOPSOIL NEEDED FOR THESE AREAS

Option 4a

Native Soil - stockpile site duff and topsoil and reapply after grading and construction.

Enter lettered areas from site plan where this option will be used:

_____ _____ _____ _____ _____ _____

Enter ***combined square footage*** of lettered areas in thousands _____
(example: for 4,525 sq ft, enter 4.525; for 500 sq ft, enter .5)

x 25

Multiply **combined square footage** by 25 and enter in box **C** _____ **C** = **Cubic Yards**

AMOUNT OF SITE TOPSOIL TO BE STOCKPILED AND REAPPLIED IN THESE AREAS

Compost and Topsoil Calculation Worksheet *Continued*

Option 4b

Disturbed Soil - Stockpile site soil, reapply, and amend in place (2.5 inch pre-approved amendment rate).

CALCULATE STOCKPILED SOIL NEEDED

Enter lettered areas from site plan where this option will be used:

_____ _____ _____ _____ _____ _____

Enter ***combined square footage*** of lettered areas in thousands _____
(example: for 4,525 sq ft, enter 4.525; for 500 sq ft, enter .5)

x 19

Multiply ***combined square footage*** by 19 and enter in box **D** → **D** = **Cubic Yards**

AMOUNT OF SITE TOPSOIL TO BE STOCKPILED AND REAPPLIED IN THESE AREAS

CALCULATE COMPOST NEEDED

Enter lettered areas from site plan where this option will be used:

_____ _____ _____ _____ _____ _____

Enter ***combined square footage*** of lettered areas in thousands _____
(example: for 4,525 sq ft, enter 4.525; for 500 sq ft, enter .5)

x 8

Multiply combined square footage by 8 and enter product in box **E** → **E** = **Cubic Yards**

AMOUNT OF COMPOST NEEDED FOR THESE AREAS

Note: If there is less stockpiled site topsoil than the amount needed to achieve the 8 inch depth once reapplied (amount in box D), additional topsoil should be purchased to make up the difference. Subtract the cubic yards of site topsoil available to be stockpiled from the total amount needed in box D to find the difference—the amount of additional topsoil that will need to be purchased. Add this additional topsoil amount to the amount in box B and enter in box G.

Order These Amounts

Add amounts in boxes A and E and enter here → **F** **Cubic Yards of Compost**

Enter box B amount here → **G** **Cubic Yards of Topsoil**
(if using Option 4b, see note under Calculate Compost Needed)

Compost and Topsoil Sources

Compost sold in Washington must be produced in a state permitted facility, which helps ensure that it meets state standards for protecting human health and the environment. Some compost facilities produce compost and topsoil mixes, and topsoil supply companies may use compost produced elsewhere to create topsoil mix products that contain the 8 – 13% soil organic matter content required in the soil standard. Ask topsoil suppliers for test results of their product to verify it contains the desired organic matter content and pH. Retain test result reports and receipts for compost and/or topsoil material delivered to the site. These will be used during inspection to verify the soil standard requirements have been met.

See *Resources* for how to find a list of permitted compost facilities. You may also see your local business directory for producers and supplier of compost and topsoil products.

Resources

Permitted Compost Facilities

For a list of permitted compost facilities, see the Washington State Department of Ecology Web site at http://www.ecy.wa.gov/programs/swfa/compost/, and click on "Permitted Compost Facilities" in the text, or call the Department's Northwest Regional Office at 425-649-7000.

Custom Amendment Rates

As an alternative to using the pre-approved amendment rate as described in this booklet, you may want to use a custom amendment rate. For information on calculating a custom amendment rate, use the DDES worksheet Calculating Custom Soil Amendment Rates for use in Achieving the Post-construction Soil Standard.

Soil Testing Laboratories

For a list of accredited soil testing laboratories and guidance on obtaining soil tests, contact the Washington State University King County Extension at 206-205-3100 or 1-800-325-6165 ext. 5-3100.

Contacts

For questions related to King County's post-construction soil standards, please contact:

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